Deer research – *past and future*

It's easy to forget that the NZ deer farming industry is only 25 years old. Research has always played a vital part in the development of the industry. In this article, Dr Ken Drew of AgResearch Invermay reviews what NZ scientists have discovered about deer production and health, and points the way to further research.

Dr Ken Drew

What do we know about deer?

First, deer are not large sheep or small cattle! They have a very seasonal physiology driven by changing daylength, which shows up in seasonal changes in body growth, reproduction, antler growth and coat change.

Research has made much progress in understanding the control of these important processes, a vital first step towards developing technologies of value to the deer sector.

While I work for AgResearch, which has by far the biggest deer R&D programme in New Zealand, there are also excellent programmes at Massey, Lincoln and Otago Universities, as well as at the Meat Industry Research Institute of New Zealand (MIRINZ).

In the very early days of deer farming we had an excellent example of what not to do. Seasonal changes in body weight suggested that stags showed minimal winter growth and therefore needed minimal feed at that time of the year.

Wrong! Better research showed that stags going into the winter have lost most of their fat, have a high metabolic rate — so lose a lot of heat — and are rather poorly insulated. This knowledge enabled scientists to develop feed tables that offered practical guidelines for farmers.

Good feed quality is particularly important for lactating hinds, and in finishing young deer to slaughter weight in the shortest possible time. Plant preference research has concluded that deer select non-ryegrass and legume components ahead of our more traditional ryegrasses.

The value of red clover and chicory for summer production and annual ryegrasses in winter is now well accepted by deer farmers.

Velvet antler

Antler growth was almost a total mystery in 1981. A few overseas people had measured the effects of nutrition on hard, or trophy, antlers but the fundamentals of velvet antler as a growing tissue were not documented.

Only after 10 to 15 years of intensive research can we capitalise on the knowledge by developing objective velvet antler grading systems and a range of new consumer products such as dietary supplements.

The formation of Velvet Antler Research NZ (VARNZ) was an excellent step forward, in which the industry contributes significant funds into applied velvet research, and in return owns half the commercially valuable intellectual property.

Breeding

We now have a detailed knowledge of the breeding cycle in farmed deer. Science can recover eggs from multi-ovulated hinds and Elk cows, fertilise them in culture with very small quantities of sperm, develop them in culture and transfer them into suitably prepared recipient females.

The system allows the rapid multiplication of elite females to top quality sires. Ultrasonic scanning of hinds to determine pregnancy status and foetal age are now routinely used during the winter in thousands of farmed deer.

A key component of reproductive technology transfer has been the work of the Deer Branch of the New Zealand Veterinary Association. Research has been frequently translated into practical technology through the annual conference and its proceedings. Most of the artificial insemination and em-

bryo transfer technology has moved into the industry via this route.

Genetic gain through objective breeding and selection at the national level has not yet really occurred. Only when deer farmers are prepared to record the performance of their deer, share information, and use systems that allow valid cross-herd comparisons will progress through breeding be possible.

Research has developed a system to provide estimated breeding values for deer from performance recording done on-farm and captured onto a database. The importation of many strains of European Red deer has given New Zealand the luxury of much diversity and variation, providing selection opportunities for all deer farmers.

Genetics

Much research has been done to provide a deer genetic map. This is extremely exciting science and definitely the way of the future.

We have already identified markers that influence variation in gestation length, pedicle initiation, birthweight, growth rate and many other traits.

Welfare

Deer behaviour is very closely linked to welfare, something we will hear a lot more about in the future. With the assistance of remote gadgetry we have learned how deer behave during yarding, truck transportation and in the deer slaughter yards. This has been important in setting up the various industry quality assurance (QA) schemes.

Deer are prone to stress, and we continue to learn how best to handle that on-farm and through the slaughter plant.

The process of harvesting velvet antler has improved enormously over the last 15 years. The scientific testing of different drug regimes and animal management procedures has been an integral part of the licensed velvet removal scheme.

It is worth remembering that until the mid-1980s there was no immediate antidote to Rompun, and there were many deaths caused by stags lying flat on the ground for long periods. An intelligent literature search turned up yohimbine as a spectacular antidote.

Health

In deer health we now know a great deal about internal and external parasitism and how to control it.

We also have a blood test to define Tb infection, and there is the prospect of identifying Tb resistant and susceptible deer from a genetic marker to allow the breeding of highly resistant deer. We also have an improving knowledge of Tb in ferrets.

Good progress is being made in finding vaccines for farmed deer and vaccines that can be delivered to feral deer and ferrets through bait.

Effectively vaccinated ferrets would allow a clean population to remain intact in any given area, preventing an influx of infected animals.

Venison research

A massive effort in deer veterinary research has produced information about many important animal and management factors influencing farm performance and profitability.

The linkage of measurable factors, such as liveweight or body condition score with production data is now rapidly moving out into the deer farming community.

We know a great deal about the commercial deer carcase and the characteristics of venison. Research has helped to produce a chilled venison product which can be shipped around the world with a 100-day shelf life.

The effects of age and sex on important meat quality attributes such as tenderness have now been well documented, as has the seasonal nature of fat deposition in Red, Wapiti and Fallow deer.

Microbiological research has shown that venison carcases can achieve some of the highest quality standards in the world. This is vital for food safety reasons and marketing success.

What do we still need to know?

Today's science is tomorrow's technology. Both are vital for New Zealand to maintain or increase its commercial advantage over the international competition.

Deer science, more than ever before, needs to develop a programme which is an integral part of the deer industry's strategic plan. Some of the important issues for science from the industry's 2010 Looking Past Tomorrow project are: safe, healthy food; animal welfare and farm environmental issues; new "natural" products; convenience and partially prepared foods. Part of the industry's strategy at another level will be improved efficiency in the farming of deer; increased rate of progress through genetic improvement; improved herd health to protect market access and minimise animal wastage.

To meet these challenges, science should address herd improvement through genetic progress. We are on the edge of a revolution through genetic marker assisted selection. Genetic markers that control important production traits and disease susceptibility will be located.

It will then be possible to scan the national herd for elite animals and use them widely.

Associated with that process will be newly developed technology allowing non-surgical egg removal from hinds for in vitro development and fertilisation. This could produce dozens of offspring.

A more dramatic but perhaps controversial process to get many more offspring from elite deer would be to use cloning.

Future health issues

Although controlling vectors in the fight against Tb is very important, it will be extremely difficult to get the incidence of deer Tb down from about 1 per cent to the internationally Tb-free figure of less than 0.2 per

Today's science will become tomorrow's on-farm technology

cent, unless other procedures are available.

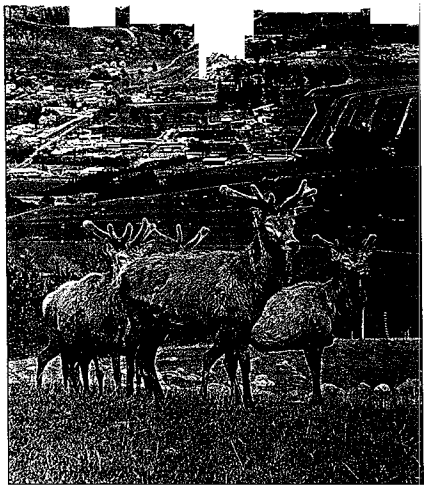
Genetic markers for resistance/susceptibility need to be found, because we know that farmers using Tb-resistant stags can expect to derive herds that are highly resistant to Tb within about 10 years.

This strategy is "clean and green", sustainable, results in permanent gains and will get rid of susceptible animals from the herd.

It is widely recognised that some very badly infected hinds in a herd that are probably highly susceptible to Tb do not react to a skin test, and are therefore left to rapidly infect others in the herd.

A new generation of testing, through use of genetic markers, will allow farmers to cull these genetically susceptible animals.

An emerging disease that could be at least as serious as Tb in deer is Johne's disease. We certainly need to know more about this condition in deer, find ways of identifying infected animals at a sub-clinical stage, and develop an effective vaccine.



Velvet stags on Invermay's deer farm

Growth potential

We now have good information about the potential for growth by breed, age and season. Many deer farmers do not come close to achieving potential growth in their herds, which is both inefficient and a problem in meeting market requirements.

Evaluation of new plant genetic material and how best to manage it with deer will be important. Extension work in putting the results into common farm practice is a continuing challenge, but will be aided by the benchmarking projects being developed in several parts of the country, where individuals can measure their animal performance against the average of others in similar circumstances.

To the market

Future venison market opportunities, especially in Europe, will produce a range of technological questions that require research.

It is clear in both Europe and North America that customers increasingly require convenience partially-cooked products using new cooking technology to provide gourmet meals in a minute or two.

An absolutely key technical element is that the products must be 100 per cent safe. Research work is urgently needed and we are not far advanced in this technology field. Eight years ago it was confidently predicted that the market for vacuum packed partially-cooked meat products in USA would rise from $15 million in 1989 to $1.7 billion by the year 2000.

The customers have clearly indicated preference, but health and food safety problems have shown that technology has not been able to deliver because the projections are not being met. Increasingly tight quality control on export venison will be necessary to position farmed venison at the high end of a niche market. We need to know what measurable factors indicate venison quality so that we can screen out product that is not up to standard.

One of those measurements may be carcase pH. Colour stability research after long term chilled storage is necessary for venison to compete with other red meats on display shelves.

Behaviour and welfare

There are many welfare matters which will have a direct effect on successful marketing of venison. We need more information on winter feeding systems, methods for lowering animal stress in all farm management procedures, improved velveting techniques which produce drug free product, better transportation procedures and ways of improving the pre-slaughter environment.

New products

Research can also provide information that will lead to novel products from animals and velvet antler. The VARNZ project is already well down this track and can be extended into a broader range of edible and wearable items.

Sustainable land use

While it might seem self-evident that farmers want to preserve their livelihoods, there is a strong international movement affecting market access that deals with environmentally friendly farming.

Soil, plant and animal science resources are needed to research ways of farming deer that are both practical and which preserve or enhance the environment of land, water and perhaps air.

An example in this line of work is in the intelligent use of trees to protect soil and provide shelter. Sustainability issues, once technical information is available, could be easily built into the farm QA scheme and be of real service to the New Zealand deer industry.

Funding

The Crown, through its Public Good Science Fund (PGSF) administered by Foundation for Research, Science and Technology (FORST), has invested heavily in deer research since 1990. The AgResearch deer programme has had the largest single contract awarded by FORST to any New Zealand science group. This is partly because the programme had heavy government investment through MAF prior to AgResearch, and partly because all animal science and some plant science skills are combined in one programme.

Government has clearly indicated that primary industry research is well down its priority list. It advises that as it reduces investment, the farming sector should invest to an increasing extent if it believes investment in R&D will bring a good return.

The current AgResearch FORST-funded deer science contract —which started on July 1, 1998 and amounts to $3.2 million —will run for six years.

However, the deer Tb project was completely unfunded by FORST from this July. The universities and MIRINZ have never had any deer research FORST investment, wholly depending on non-government research funds.

The deer industry, through the NZGIB and NZDFA, has significantly invested into R&D, especially through the VARNZ joint venture with AgResearch. It should be looking to expand that approach through targeted research on topics important to the industry.

Scientists are now familiar with the culture which requires objectives to be written, the project completed within budget and on-time, with a suitable report to present results and their implications.

The deer industry has benefited enormously over 25 years from science input — I concede parochialism here! The best way to protect the collective knowledge base so that further productive advances can be made is for the deer industry to establish a close working partnership with the science groups.

That will mean required industry outcomes are driven by a mixture of PGSF and industry investment. ■